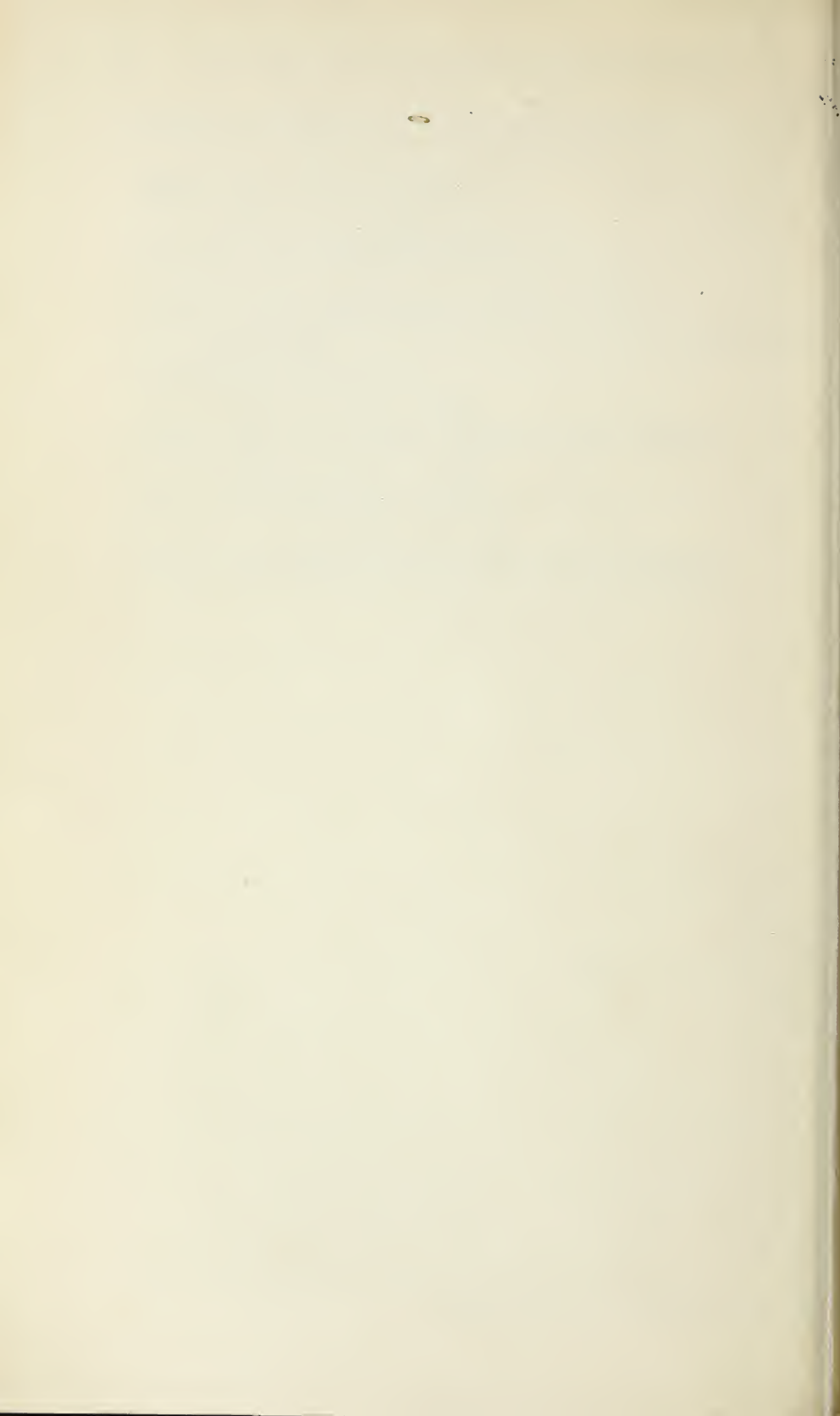


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64

HOW LUMBER IS GRADED

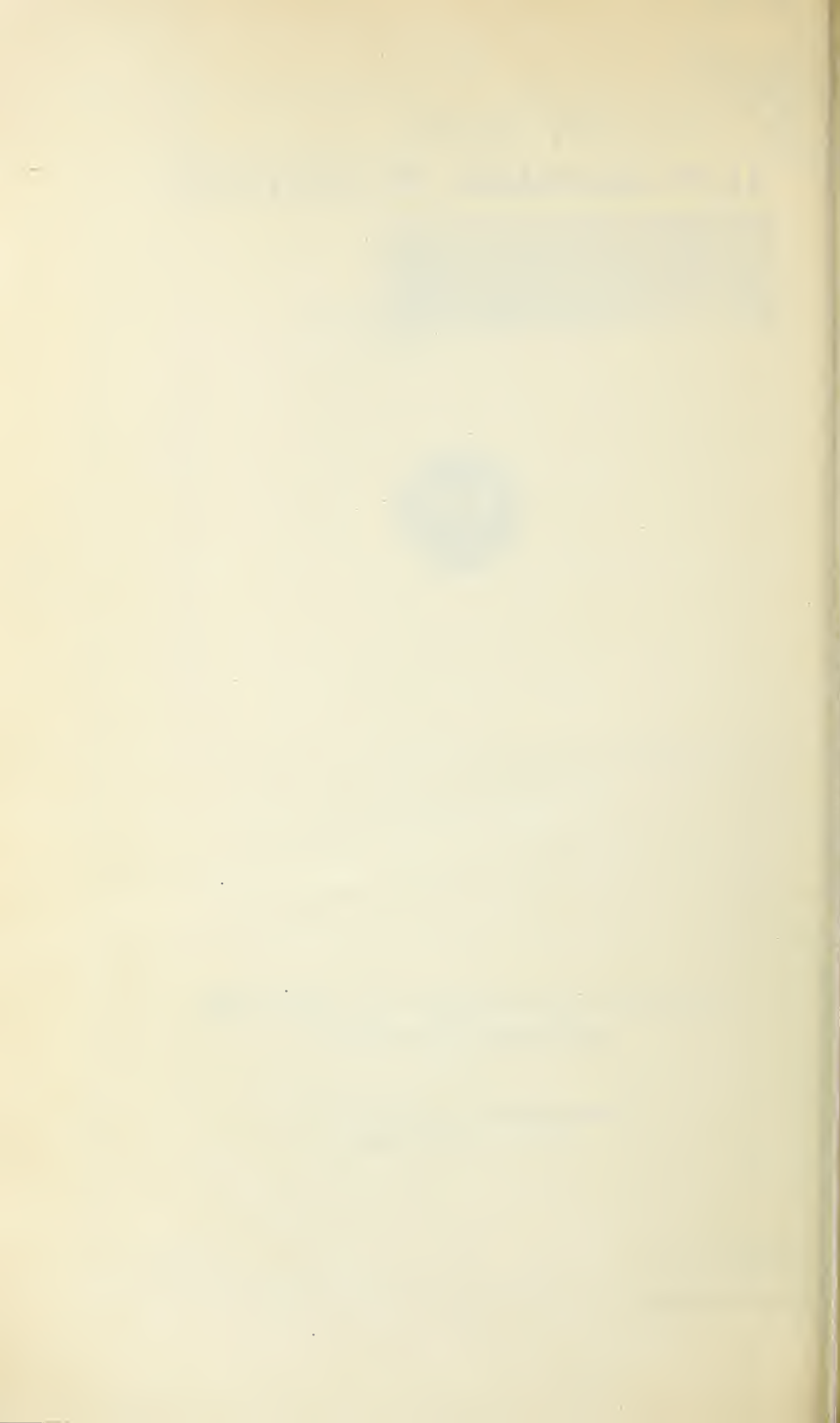
H. S. BETTS,

Engineer in Forest Products, Forest Service



UNITED STATES DEPARTMENT OF AGRICULTURE
DEPARTMENT CIRCULAR 64

Contribution from the Forest Service
HENRY S. GRAVES, Forester



HOW LUMBER IS GRADED.

By H. S. BETTS,

Engineer in Forest Products, Forest Service.

CONTENTS.

	Page.		Page.
Hardwood lumber grading-----	5	Description of typical rules—Contd.	
Softwood lumber grading-----	12	Redwood-----	36
Description of typical rules-----	22	Eastern spruce-----	37
Southern yellow pine-----	22	Sitka spruce-----	37
White pine — eastern or north- ern-----	30	Engelmann spruce-----	38
Douglas fir-----	31	Tamarack and larch-----	38
Idaho white pine and western yellow pine-----	34	Southern red cedar-----	38
Sugar pine-----	35	Western red cedar-----	38
Hemlock-----	35	Southern white cedar-----	38
Cypress-----	36	Port Orford cedar-----	38
		Lodgepole pine-----	39
		White fir-----	39

THE boards cut in a sawmill from logs of various kinds vary widely in quality. Some boards are very knotty, others have a few knots, and still others are clear. Some contain checks or splits and others have bark on the edges or are somewhat decayed in places. The clear boards are more valuable for most purposes than those with knots, so it becomes necessary to separate the lumber as it comes from the mill into classes or grades. The lumber in these grades varies in quality from practically clear boards in the highest grade to lumber in the lowest grade containing so many knots, checks, and other defects that it is unfit for anything except perhaps temporary construction or for cutting up so as to obtain small, clear pieces, the defective parts being discarded. Figure 1 shows six grades of North Carolina (loblolly) pine boards ranging from the highest grade, designated as "No. 1" in the grading rules for this particular wood, to the lowest grade, designated as "bark strips."

The use to which lumber is to be put determines the number, size, and position of the defects it may contain and still be satisfactory. In siding, for example, a reasonable number of knots on the edges which are covered when the siding is in place may evidently be allowed. In flooring some knots and other defects on the under side are allowable, since they will not show when the flooring is in use. Sheathing and subflooring may have a considerable number of defects, since both kinds of lumber are entirely covered by finishing material. Covered lumber, such as sheathing, should, of course, be free from decay, even if it does not show, as the decay is quite likely to spread rapidly. Door panels are an example of very high-grade lumber that should be clear on both sides.

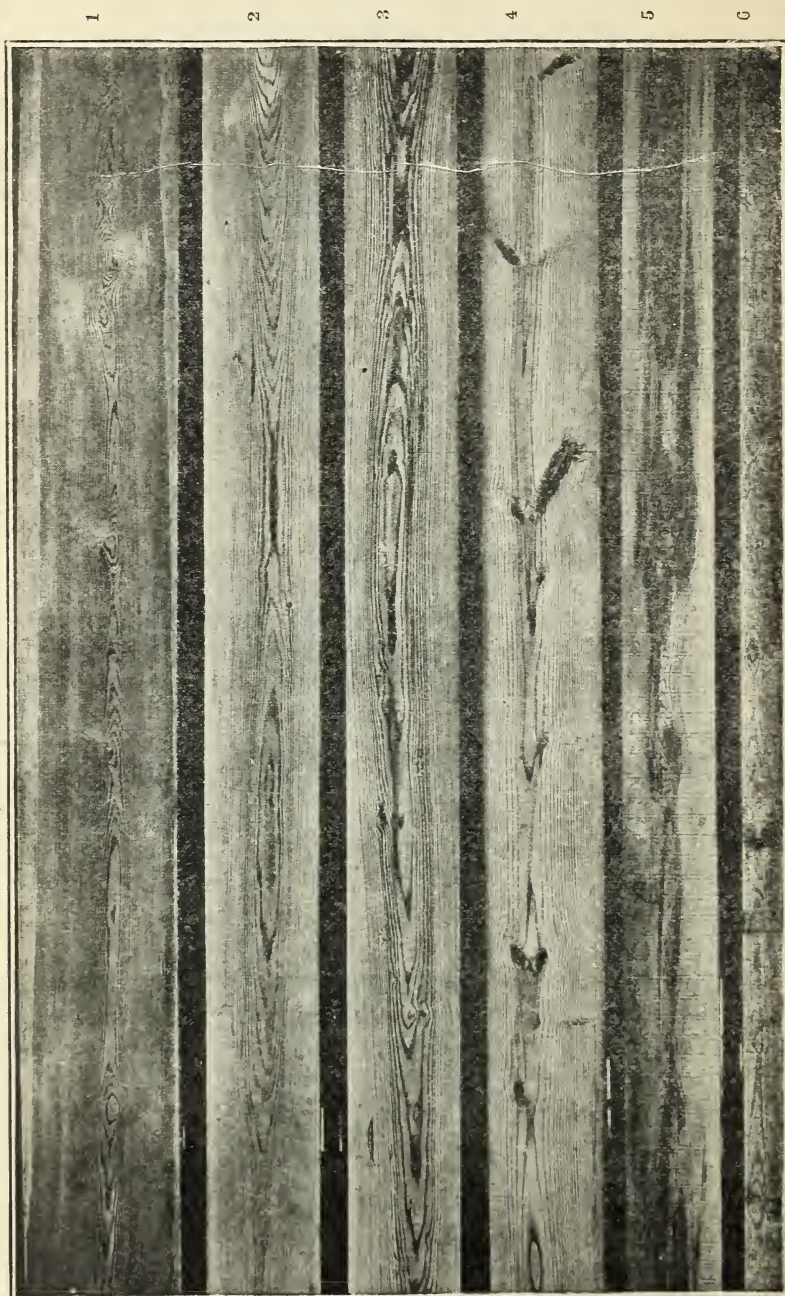


FIG. 1.—Six grades of North Carolina (loblolly) pine boards graded under the North Carolina Pine Association rules.

The location of defects in a piece of lumber determines the length and width of clear pieces that can be cut from it and the waste that will occur when the cuttings are made. Furniture requires comparatively short, wide pieces of clear lumber, while rails for porches and stairs require long, narrow, clear lengths. Lumber from which a large proportion of furniture stock could be cut might yield very little rail stock.

The condition of defects may also influence the grade of a piece of lumber. Tight knots in certain grades of siding or ceiling may be allowed, while loose knots likely to drop out would be objectionable.

The grading rules in general use at present with very few exception¹ have to do only with defects and do not take into account the quality of the wood itself. That is, if two boards of the same species are clear or if they have similar defects, both boards are placed in the same grade regardless of the quality of the wood itself. As a matter of fact, the wood in one board may be dense, heavy, and strong and the wood in the other light and weak. For some purposes, such as siding, ceiling, or finish, it may not matter whether dense or light wood is used; but for other purposes, such as vehicle parts, structural timber, or flooring, where strength or hardness is a prime requisite, the wood must be dense to give satisfactory service.

The rules at present used for grading lumber were prepared largely by lumber associations. The members of these associations are made up of manufacturers and dealers who handle lumber of one or more species that grow in a certain region or are naturally grouped together. For example, the grading rules of the Northern Pine Manufacturers' Association cover four woods—white pine, Norway pine, spruce, and tamarack—all of which grow in the Lake States region. On the other hand, the National Hardwood Lumber Association, as its name implies, includes all hardwoods. Its members are made up of wholesalers and manufacturers located largely in or near the hardwood forest regions of the Eastern States. Figure 2 is an outline map of the United States on which are indicated the names and locations of the principal lumber associations and the woods covered by the grading rules of each.

HARDWOOD LUMBER GRADING.

The rules which are considered standard for grading hardwood lumber in the United States are those adopted by the National Hardwood Lumber Association.²

The grades adopted by the association for various hardwood products are given in a brief summary of the grading rules on pages 8 to 11.

¹ Southern Pine Association rules and West Coast Lumbermen's Association rules.

² This association publishes a booklet of over 100 pages which contains detailed grading rules for various hardwood products, such as lumber, flooring, vehicle stock, etc.

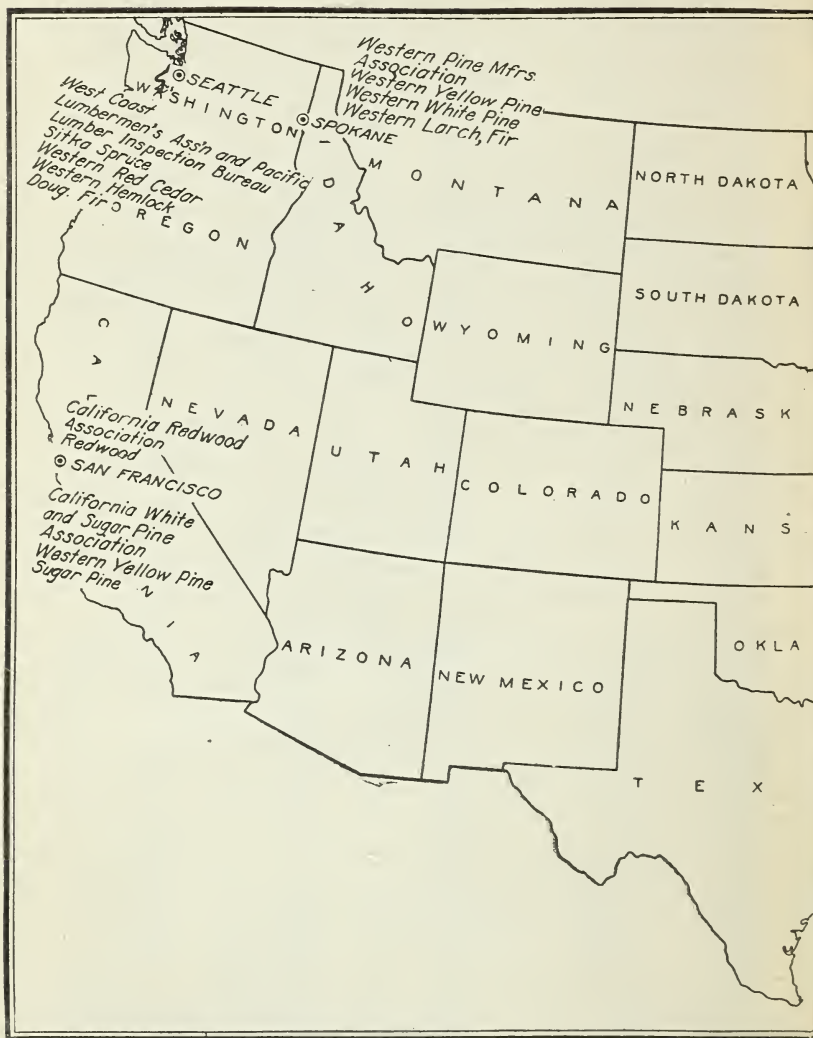
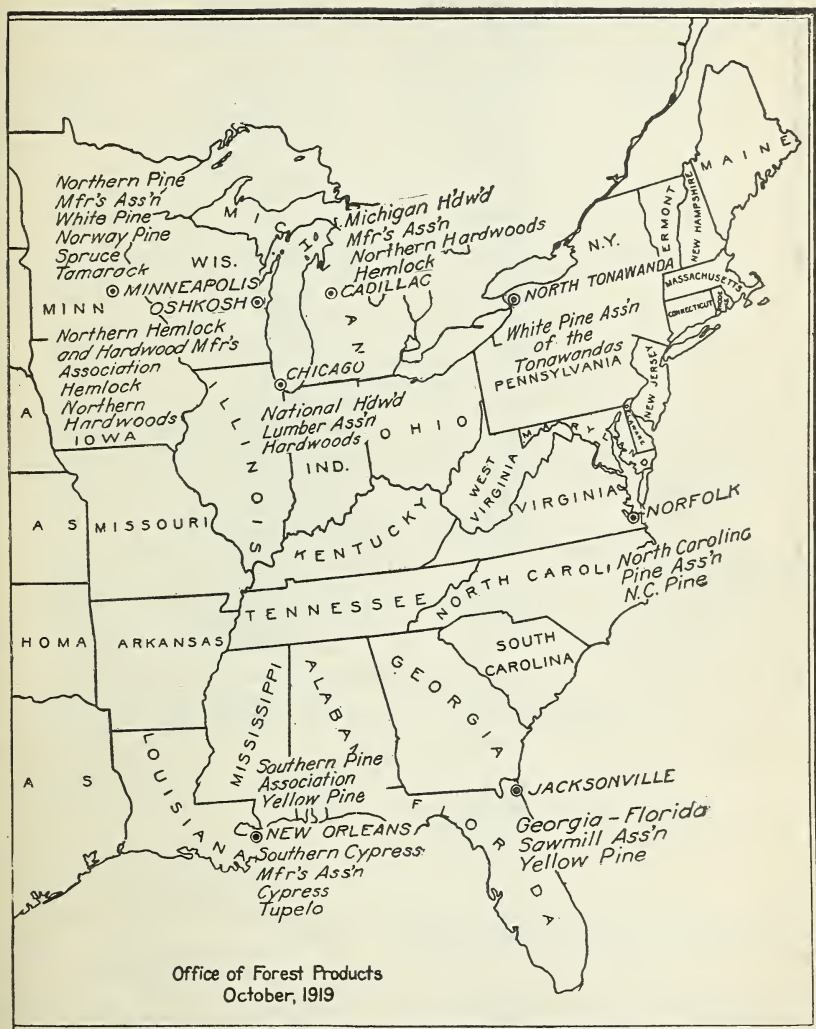


FIG. 2.—The principal lumber manufacturers' associations.



showing headquarters and woods covered by grading rules.

GRADES FOR Rules of the National Hardwood

GRADES FOR PRODUCTS OF VARIOUS KINDS OF HARDWOODS.

Species of wood.	Product.	Grade.
Ash.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
	Wagon poles.....	Nos. 1, 2.
Basswood.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
	Wagon box boards.....	Nos. 1, 2.
Beech.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Flooring.....	Red Clear, Clear, No. 1, Factory.
Birch.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
	Flooring.....	Red Clear, Clear, No. 1, Factory.
Buckeye.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Butternut.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
Cherry.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
Chestnut.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common, Sound Wormy.
Cottonwood.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Wagon box boards.....	Nos. 1, 2.
Cypress.....	See "Grades for Softwood Products."	
Elm (rock).....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Elm (soft).....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
Gum (black).....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Gum (red)—plain sawed.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Wagon box boards.....	Nos. 1, 2.
	Panel stock.....	Panel, Wide No. 1.
Gum (red)—plain sawed, figured wood.	Lumber.....	F & S, Selects, Nos. 1, 2 Common.
Gum (red)—sap.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Gum (red)—quarter sawed.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Gum (red)—quarter sawed, figured wood.	Lumber.....	F & S, Selects, Nos. 1, 2 Common.
Gum (red)—sap, no defect.....	Lumber.....	F & S, Selects, Nos. 1, 2 Common.
Hackberry.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Hickory.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Wagon stock:	
	Axles.....	Nos. 1, 2.
	Bolsters.....	Nos. 1, 2.
	Sandboards.....	Nos. 1, 2.
	Reaches.....	Nos. 1, 2.
	Eveners.....	Nos. 1, 2.
Locust.....	Lumber.....	F & S, Selects, Nos. 1, 2 Common, Sound Wormy, No. 3 Common.
Magnolia.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Wagon box boards.....	Nos. 1, 2.
Mahogany (Mexican and African).....	Lumber.....	F & S, Nos. 1, 2 Common, No. 1 Wormy, No. 2 Wormy, Shorts, Counters.
	Strips.....	Clear, Nos. 1, 2 Common.
Mahogany (Cuban).....	Lumber.....	Prime, Selects, Rejects, Shorts, Wormy, Counters, Clear Strips.
Mahogany (Philippine).....	Lumber.....	F & S, Selects, Nos. 1, 2 Common, Shorts, Counters.
Maple (hard).....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
	Flooring.....	White Clear, Clear, No. 1, Factory.
Maple (soft).....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.

HARDWOOD LUMBER.

Lumber Association, July, 1919.

SUMMARY OF GRADING RULES.**1. WOODS INCLUDED.**

Ash.	Chestnut.	Magnolia.	Pecan.
Basswood.	Cottonwood.	Mahogany (African).	Poplar.
Beech.	Cypress.	Mahogany (Cuban).	Red gum.
Birch.	Elm (rock).	Mahogany (Mexican).	Sycamore.
Birch (red).	Elm (soft).	Mahogany (Philippine).	Tupelo (bay poplar).
Black gum.	Gum (black).	Maple (hard).	Walnut.
Buckeye.	Hackberry.	Maple (soft).	Willow.
Butternut.	Hickory.	Oak (red).	
Cherry.	Locust.	Oak (white).	

2. STANDARD LENGTHS.

Standard lengths are from 4 to 16 feet, inclusive, in one-foot multiples, but not over 15 per cent of odd lengths is admitted.

3. STANDARD THICKNESSES FOR ROUGH LUMBER.

$\frac{1}{4}$ "	$\frac{3}{8}$ "	$1\frac{1}{4}$ "	2"	$3\frac{1}{2}$ "	5"
$\frac{3}{8}$ "	$\frac{1}{2}$ "	$1\frac{1}{2}$ "	2 $\frac{1}{2}$ "	4"	$5\frac{1}{2}$ "
$\frac{1}{2}$ "	1"	$1\frac{3}{4}$ "	3"	$4\frac{1}{2}$ "	6"

The standard thickness of lumber surfaced on two sides are $\frac{1}{16}$ " less for pieces 1" and under, $\frac{5}{32}$ " for pieces $1\frac{1}{4}$ " and $1\frac{1}{2}$ ", and $\frac{1}{4}$ " for pieces $1\frac{3}{4}$ " and over. Surfaced lumber is measured on the basis of rough dimensions.

4. STANDARD GRADES.

Firsts*.....	No. 1 Common.
Seconds*.....	No. 2 Common.
Selects.....	No. 3 Common.

*Firsts and Seconds are generally considered as one grade (F & S).

5. DESCRIPTION OF STANDARD GRADES.

(Inspection to be made on the poor side of the piece.)

GRADE—FIRSTS.

Lengths allowed.	Widths allowed.	Defects allowed.
8' to 16'.....	6" and wider.....	Ranging from no defects in pieces 4 sq. ft. to 9 sq. ft. surface measure to 2 defects in pieces of 16' and over surface measure.

GRADE—SECONDS.

8' to 16'.....	6" and wider.....	Ranging from 1 defect in pieces 5 sq. ft. surface measure to 5 defects in pieces 20 sq. ft. surface measure.
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GRADE—SELECTS.

6' to 16'..... (Not over 30% under 12' and not over 5% of 6' and 7' lengths.)	4" and wider.....	Ranging from no defects on one side of piece 6' and 7' long with reverse side not below No. 1 Common to pieces 7" and wider and 10' and longer with defects that do not cause a waste of more than 1" in width for the full length or its equivalent on one or both ends with reverse side not below No. 1 Common.
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GRADES FOR HARDWOOD**Rules of the National Hardwood Lumber**

GRADES FOR PRODUCTS OF VARIOUS KINDS OF HARDWOODS—Continued from
p. 8.

Species of wood.	Product.	Grade.
Oak (red and white)—plain sawed..	Lumber.....	F & S, Selects, Nos. 1, 2 Common, Sound Wormy, No. 3 Common.
	Flooring.....	Clear, Selects, Nos. 1, 2 Common.
	Common dimension.....	One grade.
	Bridge plank.....	Nos. 1, 2.
	Sound square edged.....	One grade.
	Plain sawed flitch.....	One grade.
	Wagon stock:	
	Axles.....	Nos. 1, 2.
	Bolsters.....	Nos. 1, 2.
	Sandboards.....	Nos. 1, 2.
	Reaches.....	Nos. 1, 2.
	Poles.....	Nos. 1, 2.
	Bending stock.....	One grade.
	Strips.....	Clear, Sap Clear, Nos. 1, 2 Common.
Oak (red and white)—quarter sawed.	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Flooring.....	Clear, Sap Clear, Select.
	Strips.....	Clear, Sap Clear, Nos. 1, 2 Common.
Pecan.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Poplar—plain sawed.....	Lumber.....	F & S, Saps, Selects, Stained Saps, Nos. 1, 2 Common, No. 2-A and 2-B Common, No. 3 Common.
	Strips.....	Clear, Nos. 1, 2 Common.
	Panel stock.....	Panel, Wide No. 1.
	Wagon box boards.....	Nos. 1, 2.
	Lumber.....	F & S, No. 1 Common.
Poplar—quarter sawed.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Sycamore—plain sawed.....	Strips.....	Clear, Nos. 1, 2 Common.
	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Sycamore—quarter sawed.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Tupelo (bay poplar).....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
	Wagon box boards.....	Nos. 1, 2.
Walnut.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.
Willow.....	Lumber.....	F & S, Selects, Nos. 1, 2, 3 Common.

In the case of lumber, the most common product, the highest grade is "Firsts" and the next grade "Seconds." Firsts and Seconds, or as they are generally written "FAS" or "F & S," are practically always combined in one grade. The third grade is "Selects," followed by Nos. 1, 2, and 3 Common, and often by special grades. The lengths and widths allowed for the various grades of each product are shown in the summary, and the number, condition, and size of defects allowed in each grade are described very briefly. The grade is based on the defects which show on the poorer side. The opposite side must, of course, be of at least as high a grade. The summary should not be regarded as a complete set of grading rules, as there are many details, exceptions, and special rules not included. However, it gives a fair idea of the differences between the grades used for hardwood lumber. It will be noted that the highest grade of "Firsts" calls for pieces containing up to 9 surface feet, to be free from all defects. Even in pieces with 16 surface feet only two defects are allowed. In the grade of

LUMBER—Continued.

Association, July, 1919—Continued.

SUMMARY OF GRADING RULES—Continued from p. 9.

5. DESCRIPTION OF STANDARD GRADES—Continued.

GRADE—NO. 1 COMMON.

Lengths allowed.	Widths allowed.	Defects allowed.
4' to 16'..... (Not over 30% under 10' and not over 10% of 4' and 5' lengths.)	3" and wider.....	Ranging from no defects in pieces 4' and 5' long to pieces 8" and wider and 14' and longer that will cut 66 $\frac{2}{3}$ % clear face in 4 cuttings. (No cutting less than 4" x 2' or 3" x 3'.)

GRADE—NO. 2 COMMON.

4' to 16'..... (Not over 10% of 4' and 5' lengths.)	3" and wider.....	Ranging from pieces 3" to 7" wide and 4' to 10' long that cut 50% clear face in 3 cuttings to pieces 8" and wider and 14' and longer that cut 50% clear face in 5 cuttings. (No cutting less than 3" x 2'.)
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GRADE—NO. 3 COMMON.

4' to 16'.....	3" and wider.....	Pieces must contain at least 25% sound cuttings. (No cutting less than 1 $\frac{1}{4}$ " wide or 36 sq. in. surface meas- ure.)
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6. STANDARD DEFECTS.

- a. *One knot* 1 $\frac{1}{4}$ " in diameter.
- b. *Two knots* not exceeding in extent or damage one 1 $\frac{1}{4}$ " knot.
- c. *One split* not averaging more than 1" to a foot and not longer in inches than the surface measure of the piece in feet.
- d. *Wane* 1" wide or one-sixth the length of the piece or its equivalent at one or both ends. Wane is bark or the lack of wood on the edge of a piece.
- e. *Worm, knot, and rafting pin holes* not exceeding in extent or damage one 1 $\frac{1}{4}$ " knot.
- f. *Heart* and other defects, not enumerated as standard defects, that do not damage the piece more than the standard defects allowed, are considered standard defects.

"Seconds" one defect is allowed in pieces with 5 surface feet, and so on up to five defects in pieces with 20 surface feet; i. e., in a board 12 inches wide one defect would be allowed about every 4 feet. It is customary to allow more defects per unit of surface measure in large pieces than in small pieces. The grade "Selects," which is next below grade "F & S," allows shorter lengths and narrower widths and is more liberal in the matter of defects. In the "Common" grades (No. 1, No. 2, and No. 3) pieces as small as 4 feet long and 3 inches wide may be included. However, only a certain percentage of such small pieces are allowed. In the "Common" grades, when pieces above a certain size have their defects sawed out, the combined surface feet in the resulting clear pieces or cuttings must not measure less than a certain proportion of the surface feet in the original piece and the cuttings must not be less than a certain size. For example, in the grade "No. 1 Common" the larger pieces must yield 66 $\frac{2}{3}$ per cent of their surface measure in cuttings without defects. Pieces graded as No. 2 Common must yield 50 per cent clear cuttings.

The lowest grade, No. 3 Common, requires only 25 per cent clear cuttings; i. e., 75 per cent of the board can be wasted in cutting out the defects. Standard defects are listed under item 6 in the summary.

The hardwood grading rules have no provision at present for distinguishing between wood that is light, brash, and weak, and wood that is heavy, tough, and strong. If two boards of ash have similar defects the rules put them in the same grade in spite of the fact that the wood in one board may be twice as strong as in the other. Figure 3 shows views of the end sections and center portions of two white ash sticks¹ tested in bending by supporting the sticks at the ends and loading them in the middle. The weight of the upper stick when thoroughly dry was 40 pounds per cubic foot, and that of the lower stick 29 pounds per cubic foot. The upper stick was about two and one-half times stronger than the lower. For uses where strength is important the necessity of providing some means of rejecting material represented by the lower stick is evident. Density or dry weight is the best criterion of strength. The proportion of summerwood (the harder, darker part of the annual ring) in the cross section is quite frequently a good indicator of density. The rate of growth (number of annual rings per inch) may or may not indicate wood of high quality. In hickory, dense wood that is strong and tough is much more likely to have less than 20 rings to the inch than more. The most reliable means of judging the strength of wood, however, is by its density or dry weight.

SOFTWOOD LUMBER GRADING.

Softwood lumber, unlike hardwood lumber, is graded under a considerable number of different rules. Not only are the different kinds of softwoods graded under different rules, but the same kinds are, in a number of cases, graded under different rules in different parts of the country and even in the same regions. Such a condition causes frequent misunderstandings between buyer and seller and is confusing to one not familiar with the grading situation. The grades adopted for the various softwood lumber products by the principal lumber associations are shown on pages 14 to 20.

¹ Both sticks were clear and straight grained and at the same moisture content when tested.

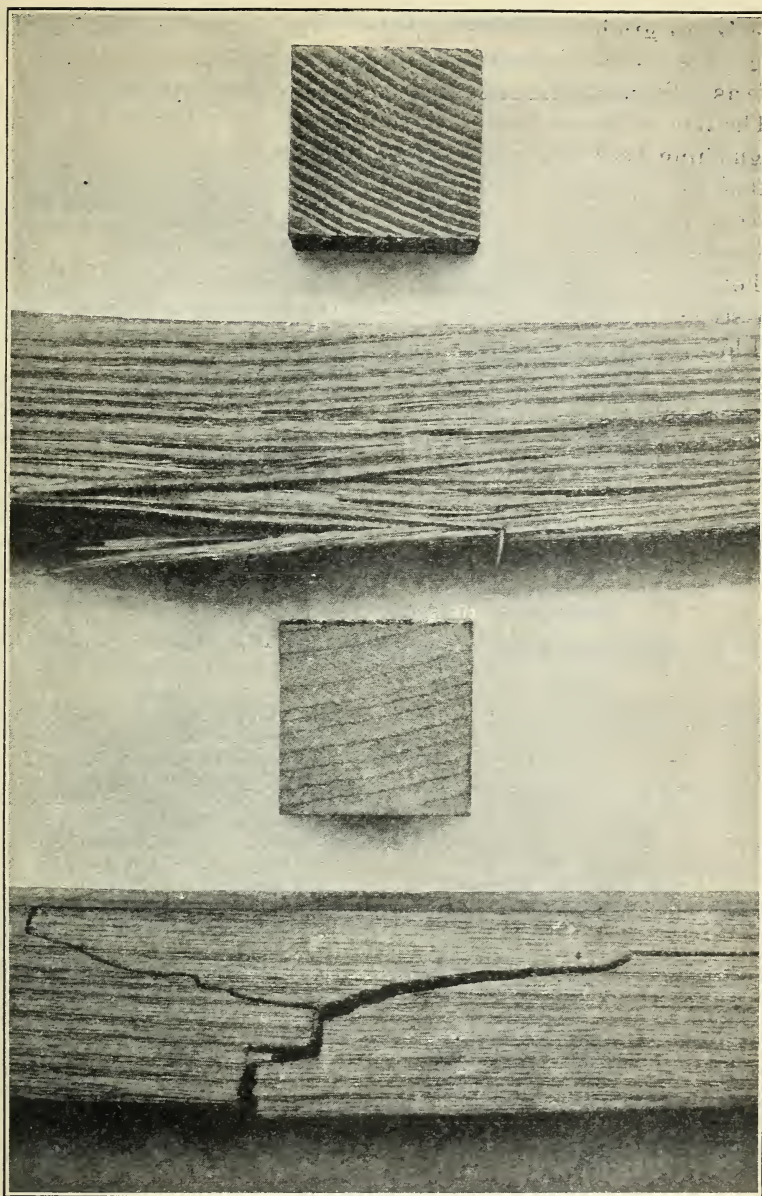


FIG. 3.—Relation of density to strength and toughness. Representative bending failures with end sections—white ash.

	Weight per cubic foot.	Toughness per cubic inch.	Bending strength per square inch.
Upper specimen.....	<i>Pounds.</i> 40	<i>Inch-pounds.</i> 47	<i>Pounds.</i> 22,700
Lower specimen.....	29	6.5	9,500

GRADES ADOPTED FOR SOFTWOOD LUMBER**SOUTHERN PINE ASSOCIATION.**

1917 Grades for Yellow Pine (longleaf, loblolly, and shortleaf pine).

Product.	Grade.
Finishing.....	A, B, C.
Panel and shop.....	Nos. 1, 2.
Flooring.....	Flat Grain—A, B, C, D, Nos. 1, 2, 3 Common. Edge Grain—A, B, C, D, No. 1 Common, No. 1 Common and Factory.
Ceiling.....	A, B, Nos. 1 and 2 Common.
Wagon bottoms.....	A and B.
Drop siding.....	A and B, Nos. 1 and 2 Common.
Bevel siding.....	A and B, Nos. 1 and 2 Common.
Partition.....	A and B, Nos. 1 and 2 Common.
Moulded casing, window and door jambs.....	A, B, and C.
Moulding.....	B and Better.
Common boards, shiplap, and barn siding.....	Nos. 1, 2, 3, 4 Common.
Grooved roofing.....	No. 1 Common.
Fencing.....	Nos. 1, 2, 3, 4.
Dimension and heavy joist.....	Nos. 1, 2, 3 Common.
Lath.....	Nos. 1 and 2.
Pickets.....	One grade.
Shingles.....	Select No. 1, Primes No. 2.
Timbers.....	Select Structural, Merchantable, Square Edge and Sound, No. 1 Common.

GULF COAST CLASSIFICATION OF PITCH PINE.*

(Adopted by Southern Pine Association. Revised May, 1910, by the Gulf Coast Lumber Exporters' Association.)

Product.	Grade.
Flooring.....	Rift, Special (Crown and French Flooring), Prime (Heart Face), Standard (Genoa Prime), Merchantable and Square Edge.
Boards and planks.....	Special (Crown), Extra (French Prime), Prime, Standard (Genoa Prime), Merchantable and Square Edge.
Deals.....	Special (Crown), Extra (French Prime), Stand- ard (Genoa Prime and Rio), Merchantable and Square Edge or Stowage.
Scantling.....	Decking, Special (Crown), Extra (French Prime), Prime, Standard (Genoa Prime), Merchantable and Square Edge.
Dimensions.....	Special (Crown), Prime, Merchantable and Square Edge.
Kiln-dried saps.....	One grade.
Air-dried saps.....	One grade.

USUAL SOUTH AMERICAN OR STANDARD RIVER PLATE.

Kiln or air dried strips.....	One grade.
Boards and planks.....	One grade.
Scantling and deals.....	One grade.
Dimensions and sawed timber.....	Special (Crown), Prime, Merchantable and Square Edge.

WEST INDIAN.

Lumber.....	Merchantable or First-Class Cuban, Second-Class Cuban, West India or Heart.
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SAWED TIMBER.

Timber.....	Merchantable Sawed Timber.
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PRODUCTS BY PRINCIPAL LUMBER ASSOCIATIONS.

GEORGIA-FLORIDA SAWMILL ASSOCIATION.

1918 Grades for Southern Yellow Pine Lumber (longleaf, loblolly, and shortleaf pine).

1. INTERSTATE RULES OF 1916.

(Yellow Pine Lumber—Classification and Inspection).

Product.	Grade.
Flooring.....	Prime. Merchantable. Standard.
Boards.....	
Plank.....	
Scantling.....	
Dimension.....	
Stepping.....	
Rough Edge or Flitch.....	

2. GRADING AND DRESSING RULES FOR PLANING MILL PRODUCTS.

Dressed finishing.....	A, B, C.
Panel shop.....	Nos. 1, 2.
Flooring or roofers.....	Flat Grain—A, B, Nos. 1, 2, 3 Common. Edge Grain—A, B, C, No. 2 Common.
Ceiling.....	A, B, Nos. 1, 2 Common.
Wagon bottoms.....	A, B.
Drop siding.....	A, B, Nos. 1, 2 Common.
Bevel siding and square edge siding.....	A, B, Nos. 1, 2 Common.
Partition.....	A, B, Nos. 1, 2 Common.
Moulded casing and base, window and door jambs.....	A, B, C.
Common boards, shiplap, and barn siding.....	Nos. 1, 2, 3, 4 Common.
Grooved roofing.....	
Fencing.....	Nos. 1, 2, 3, 4 Common.
Lath.....	Nos. 1, 2.
Shingles.....	Nos. 1, 2.

NORTH CAROLINA PINE ASSOCIATION.

1917 Grades for Kiln Dried North Carolina Pine (loblolly pine and shortleaf pine).

Product.	Grade.
Rough and dressed lumber.....	Nos. 1, 2, 3, Box, Culls, Merchantable Red Heart, Cull Red Heart, Nos. 1 and 2 Shop, Nos. 1 and 2 Bark Strips, Box Bark Strips.
Flooring.....	Nos. 1, 2, 3, and 4 Flat Grain, Nos. 1 and 2 Rift
Ceiling.....	Nos. 1, 2, 3, and 4.
Partition.....	Nos. 1, 2, 3, and 4.
Fencing.....	Nos. 1, 2, 3, and 4.
Base and casing.....	Nos. 1 and 2.
German, bevel, and drop siding.....	Nos. 1, 2, 3, and 4.
Rails.....	Nos. 1 and 2.
Mouldings.....	No. 1.
Factory flooring and roofers.....	Same as Box.
Plank, dimension, and timber.....	One grade.

Grades for air-dried boards are Nos. 1, 2, 3, Box and Culls.

CALIFORNIA REDWOOD ASSOCIATION.

Grades for Redwood, dated April 5, 1917.

Product.	Grade.
Uppers.....	Clear, Sap Clear, Select, Standard.
Sundry commons.....	Extra Merchantable, Construction, Merchantable Shop.

GRADES ADOPTED FOR SOFTWOOD LUMBER PRODUCTS**NORTHERN HEMLOCK AND HARDWOOD MANUFACTURERS' ASSOCIATION.**

Grades for Hemlock (eastern), dated February 1, 1918.

Product.	Grade.
Boards and strips.....	Thick D and Better, Inch Clear and Select, Inch D Stock, Inch No. 1 and No. 2 Common, Inch Merchantable, Select Inch No. 3, Inch Box and Crating, Inch No. 3 and No. 4 Common.
Piece stuff or dimension.....	No. 1, No. 2 Dimension, Merchantable Dimension, Select No. 3 Dimension, Box and Crating Dimension, No. 3, No. 4 Dimension.
Lath.....	No. 1, No. 2.

MICHIGAN HARDWOOD MANUFACTURERS' ASSOCIATION.

Rules for grading and inspection of Hemlock (eastern) lumber, dated January 20, 1910.

Product.	Grade.
Boards and strips.....	C and Better. No. 1 Common, No. 2 Common. No. 3 Common, No. 1 Sheathing or No. 4, No. 2 Sheathing or No. 5, 4-4 Merchantable or No. 3 and Better.
Piece stuff.....	8-4 Nos. 1, 2, 3, 8-4 Merchantable Timbers.

NORTHERN PINE MANUFACTURERS' ASSOCIATION.1915 Grades for Northern White Pine (*Pinus strobus*), Spruce, and Tamarack Lumber.

Product.	Grade.
Finishing lumber.....	1st, 2d, and 3d Clear, A, B, C, D, Select, D Stock and Box.
Siding.....	A and Clear, B, C, D, E.
Flooring.....	A, B, C, D, Farmers' Clear, Nos. 1, 2, 3 Fencing (D and M).
Common lumber.....	Nos. 1, 2, 3 Common, Boards and Strips. No. 4 Boards and Strips, No. 5 Boards.
Joists, scantling, and timber.....	Nos. 1, 2, 3.
Thick common lumber.....	Tank Stock, Select Common, Nos. 1, 2, 3, 4, 5 Common.
Factory lumber.....	Factory Plank, Nos. 1, 2, 3 Shop Common, A and Better Factory Selects, B Factory Selects, C Factory Selects, Inch Shop Common, Short Box.
Lath.....	No. 1 White Pine, No. 1 Mixed, No. 2.

WHITE PINE ASSOCIATION OF THE TONAWANDAS.Grades for White Pine (*Pinus strobus*), not dated.

Product.	Grade.
Lumber.....	Uppers, Selects, Fine Common, Nos. 1, 2, and 3 Cuts, No. 1 and 2 Mouldings, Stained Saps, Star Clear, No. 1 Shelving and Dressing, No. 2 Dressing, Nos. 1 and 2 Shelving, Nos. 1, 2, and 3 Barn, No. 1 Box.
Bevel siding, mouldings, lattice, pickets, box shooks, dimension shingles.	

BY PRINCIPAL LUMBER ASSOCIATIONS—Continued.

SOUTHERN CYPRESS MANUFACTURERS' ASSOCIATION.

March 1, 1918, Grades for Cypress and Bay Poplar (tupelo).

1. CYPRESS.

Product.	Grade.
Tank stock.....	One grade.
Lumber.....	A, B, C, Factory Selects, Shop Select Common. Heart Select Common, No. 1 Common, No. 2 Common, Box and Peck.
Switch ties.....	One grade.
Crossties.....	Standard No. 1 Peck.
Panel stock.....	B and Better.
Bevel siding.....	A, B, C, and D.
Flooring, ceiling, drop siding, shiplap, moulded casing, base, and grooved roofing.....	A, B, C, and D.
Partition.....	A, B, C, and D.
Window and door frame stock, jambs, etc.....	B and Better.
Short lumber.....	B and Better.
Pickets.....	Nos. 1, 2.
Battens.....	Select Common and Better.
Turning squares.....	One grade.
Car roofing and siding.....	C and Better.
Car lining.....	One grade.
Shingles.....	Bests, Primes, Star "A," Star Economy, Clippers.

2. BAY POPLAR (TUPELO).

Wagon box boards.....	One grade.
Lumber.....	Firsts and Seconds, Nos. 1, 2, and 3 Common, B and Better, C.
Flooring, ceiling, and partition.....	B and Better, C.
Drop siding.....	C and Better.
Bevel siding.....	B and Better, C.

PACIFIC LUMBER INSPECTION BUREAU.

(Export Shipments.)

Grades for Douglas Fir, Western Hemlock, and Sitka Spruce, dated 1917.

1. DOUGLAS FIR AND WESTERN HEMLOCK.

Product.	Grade.
Rough clears.....	No. 2 Clear and Better Edge Grain, No. 2 Clear and Better Flat or Edge Grain.
Lumber.....	Merchantable, Common.
Mining lumbers.....	One grade.
Railroad ties.....	One grade.
Ship plank.....	One grade.
Deck plank.....	One grade.
Stepping.....	No. 2 Clear and Better.
Pipe stock.....	One grade.
Flooring.....	Nos. 1, 2, and 3 Clear Edge Grain, No. 2 Clear and Better Flat Grain, No. 3 Clear Flat Grain.
Ceiling.....	No. 2 Clear and Better.
Rustic siding.....	No. 2 Clear and Better.
Pickets.....	One grade.
Staves.....	Nos. 1, 2.
Lath.....	One grade.

2. SITKA SPRUCE.

Rough clears.....	No. 2 Clear and Better.
Rough shelving.....	No. 3 Clear and Better.
Rough merchantable.....	One grade.
Merchantable box.....	One grade.

GRADES ADOPTED FOR SOFTWOOD LUMBER PRODUCTS**WEST COAST LUMBERMEN'S ASSOCIATION.**

Grades for Douglas Fir, Sitka Spruce; Western Red Cedar, and Western Hemlock.

Dated January 1, 1917, marked "Rail A."

1. DOUGLAS FIR AND WESTERN HEMLOCK.

Product.	Grade.
Flooring.....	Vertical Grain—Nos. 1, 2, 3 Clear. Flat Grain— No. 2 Clear and Better, No. 3 Clear and No. 4 Clear.
Ceiling, partition.....	No. 2 Clear and Better, No. 3 Clear and No. 4 Clear.
Finish, casing, base.....	Selected Flat Grain, No. 2 Clear and Better, No. 3 Clear.
Stepping (vertical grain).....	No. 2 Clear and Better, No. 3 Clear.
Drop siding, rustic.....	No. 2 Clear and Better, No. 3 Clear, No. 4 Clear.
Bungalow or Colonial siding.....	One grade.
Bevel siding.....	No. 2 Clear and Better, No. 3.
Silo stock.....	No. 2 Clear and Better, Selected Common.
Well tubing.....	No. 3 Clear and Better.
Corn cribbing.....	No. 3 Clear and Better, Selected Common.
Wagon bottoms.....	No. 2 Clear and Better Flooring or No. 2 V. G. Flooring.
Porch columns.....	One grade.
Pickets (square and flat).....	One grade.
Lath.....	One grade.
Battens.....	One grade.
Pipe staves.....	One grade.
Tank stock.....	One grade.
Ship decking.....	One grade.
Turning squares.....	No. 2 Clear and Better.
Boards and shiplap.....	Selected Common, Nos. 1, 2, 3 Common.
Well curbing.....	Selected Common, No. 1 Common.
Dimension, plank, small timbers.....	Selected Common, No. 1, 2 Common.
Windmill stock.....	Selected Common.
Timbers.....	Selected Common, No. 1, 2 Common.
Mining timber.....	No. 1.
Factory lumber.....	Factory Plank, Factory Select and Better, No. 1 Shop Common, No. 2 Shop Common, 1" Shop Common.
Panel lumber.....	One grade.

2. SITKA SPRUCE.

Finish.....	B and Better.
Flooring.....	B and Better.
Stepping.....	B and Better.
Battens.....	B and Better.
Partition.....	B and Better.
Bevel siding.....	A, B, C.
Wagon box sets.....	B and Better.
Boards and strips.....	Selected Common, No. 1 Common.
Dimension, plank, and small timbers.....	Selected Common, Common.
Lath.....	One grade.
Turning squares.....	One grade.
Moulding stock.....	One grade.
Panel stock.....	Nos. 1, 2.
Factory lumber.....	Select Factory, No. 1 Shop, No. 2 Shop, 1 Inch Shop Common.
Car siding and roofing.....	B and Better.
Ladder stock.....	One grade.
Cut-up sash and door stock.....	Nos. 1, 2.
Piano posts.....	One grade.
Soundng-board stock.....	One grade.
Box lumber.....	Nos. 1, 2, 3.
Airplane stock.....	One grade.
Flitches.....	One grade.

BY PRINCIPAL LUMBER ASSOCIATIONS—Continued.

WEST COAST LUMBERMEN'S ASSOCIATION—Continued.

3. WESTERN RED CEDAR.

Product.	Grade.
Bevel siding.....	Clear, A, B.
Lath.....	One grade.
Bungalow or colonial siding.....	One grade.
Finish.....	No. 2 Clear and Better.
Porch decking.....	No. 2 Clear and Better.
Flooring.....	No. 2 Clear and Better.
Porch columns and newels.....	One grade.
Boards and shiplap and D. & M.....	No. 1 and No. 2 Common.

PACIFIC LUMBER INSPECTION BUREAU.

(Domestic Shipments.)

Grades for Douglas Fir, Western Hemlock, Sitka Spruce, and Western Red Cedar, dated 1917.

1. DOUGLAS FIR AND WESTERN HEMLOCK.

Product.	Grade.
Rough clears.....	No. 2 Clear and Better Edge Grain, No. 2 Clear and Better Flat Grain, No. 3 Clear Edge Grain, No. 3 Clear Flat Grain.
Tank stock (Flat or Edge Grain).....	One grade.
Cross arm stock.....	One grade.
Silo stock.....	No. 2 Clear and Better, Selected Common.
Pipe stave stock.....	One grade.
Ship plank.....	One grade.
Ship decking.....	One grade.
Factory lumber.....	Factory Plank, Factory Select and Better, No. 1 Shop Common, No. 2 Shop Common, 1" Shop Common.
Panel lumber.....	One grade.
Boards and shiplap.....	One-inch Selected Common, Nos. 1, 2, 3 Common.
Dimension, plank, and small timbers.....	Selected Common, Nos. 1, 2, 3 Common.
Timbers.....	Selected Common, Nos. 1, 2 Common.
Mining timber.....	One grade.
Railroad ties.....	No. 1 and No. 2 Ties.
Car stakes.....	One grade.
Pickets.....	One grade.
Lath.....	One grade.
Flooring.....	Nos. 1, 2, 3 Clear Edge Grain, No. 2 Clear and Better Flat Grain, No. 3 Clear Flat Grain, No. 4 Flat or Edge Grain.
Ceiling and partition.....	No. 2 Clear and Better, No. 3, Clear, No. 4 Clear.
Drop siding, rustic.....	No. 2 Clear and Better, No. 3 Clear, No. 4 Clear.
Bungalow or Colonial siding.....	One grade.
Finish, casing, base.....	Selected Flat Grain, No. 2 Clear and Better, No. 3 Clear.
Stepping.....	No. 2 Clear and Better, No. 3 Clear.

2. SITKA SPRUCE.

Finish.....	B and Better.
Factory plank.....	Factory Select and Better, No. 1, No. 2 Shop Common, 1-inch Shop Common.
Box lumber.....	Nos. 1, 2, 3.

3. WESTERN RED CEDAR.

Bevel siding.....	Clear, A, B.
Bungalow or Colonial siding.....	One grade.
Finish.....	No. 2 Clear and Better.
Porch decking.....	No. 2 Clear and Better, No. 3 and No. 4 Clear.
Flooring.....	No. 2 Clear and Better, No. 3 and No. 4 Clear.
Boards and shiplap.....	No. 1 and No. 2 Common.
Lath.....	One grade.
Shingles.....	Perfects, Extra Clears, Extra Star "A" Stars, Dimension.

GRADES ADOPTED FOR SOFTWOOD LUMBER PRODUCTS BY PRINCIPAL LUMBER ASSOCIATIONS—Continued.

NATIONAL HARDWOOD LUMBER ASSOCIATION.

August, 1917, Grades for Cypress.

Product.	Grade.
Tank.....	One grade.
Lumber.....	Firsts and Seconds, Selects, Nos. 1 and 2 Shop, Nos. 1 and 2 Common, Nos. 1 and 2 Boxing, Peck.
Finished cypress.....	A, B, C, and D Finish.
Panel.....	B and Better Finish.
Siding.....	A, B, C, and D.
Flooring and ceiling.....	A, B, C, and D.
Partition.....	One grade.
Car roofing and siding.....	C and Better.
Car lining.....	One grade.
Battens.....	One grade.
Turning squares.....	One grade.
Pickets and lath.....	Nos. 1 and 2.
Shingles.....	Bests, Primes, Star "A," Star Economy, Clippers.

WESTERN PINE MANUFACTURERS' ASSOCIATION.

(Revised edition of March 1, 1917.)

Grades for Western White Pine (*Pinus ponderosa*) (western yellow pine), and Idaho White Pine (*Pinus monticola*), Spruce, White Fir, Cedar, Fir, and Larch.

Product.	Grade.
Finishing lumber.....	B Select and Better, C Select, D Select.
Siding.....	B and Better, C, D, E.
Common lumber.....	No. 1, 2, 3, 4 Boards and Strips, No. 5 Boards.
Tank stock.....	One grade.
Factory lumber.....	No. 1 Door Cuttings, No. 2 Door Cuttings, Nos. 1, 2, 3 Shop Common, Factory Selects, Inch Shop Common, Short Box.
Dimension and timbers.....	No. 1.
Cribbing.....	One grade.
Lath.....	No. 1 Pine Lath, No. 1 Mixed Lath, No. 2 Lath.

CALIFORNIA WHITE AND SUGAR PINE MANUFACTURERS' ASSOCIATION.

Grades for Sugar Pine and California White Pine (western yellow pine).

(Revised June 2, 1918.)

Product.	Grade.
Thick finishing.....	Nos. 1 and 2 Clear or B Select and Better, C Select, D Select.
Inch finishing.....	Nos. 1 and 2 Clear or B Select and Better, C Select, D Select.
Siding.....	B and Better, C, D.
Flooring, drop siding, and ceiling.....	B and Better, C, D, Nos. 1, 2, 3 Fencing, D. & M.
Factory plank.....	Nos. 3 Clear or Factory Select, Nos. 1, 2, 3 Shop, Inch No. 3 Clear, Inch Shop.
Thick common lumber.....	Select Common Dimension.
Common boards and fencing.....	Nos. 1, 2, 3, 4 Common.
Shiplap, grooved roofing, and D. & M.....	Nos. 1, 2, 3 Common.
Lath.....	Nos. 1, 2.

The various mills originally made their own rules to suit their special conditions. While such a condition might be satisfactory where a mill supplied practically all the lumber used in its vicinity, as soon as mills with different rules for the same timber began to sell in the same territory, confusion and dissatisfaction were bound to result. As means of transportation grew easier and cheaper and lumber was shipped greater distances from its source, organizations of manufacturers and dealers in different regions drew up rules to enable them to handle lumber of standard sizes and with less misunderstanding as to quality. By the use of such rules manufacturers could tell more satisfactorily the quality of lumber wanted by dealers and the dealers in turn could be surer that their orders would be correctly filled. These rules first classified the various kinds of lumber products, as siding, boards, ceiling, flooring, finishing, dimension, etc., and then specified the size and number of defects, such as knots and checks, allowed in the various grades of each product. At first the rules were comparatively simple, but they have been expanded, and new ones added to cover special products, and the rules for any one product further subdivided until pamphlets of 50 or more printed pages may be required to describe the different grades, sizes, and shapes of the various standard lumber products of one kind of wood.

The most common defects specified in softwood-grading rules are knots, stained sap, shake, wane, rot, pitch, splits, and seasoning checks. Inspection is usually specified on the better or dressed side. However, factory lumber used for the manufacture of doors, sash, etc., which must show on both sides, is graded from the poorer side. There is a tendency to avoid definite detailed specifications for the different grades, especially in certain of the white-pine grading rules, where only a general description of each grade and numerous examples of pieces that should be admitted are given. Consequently the grade of each piece may be left largely to the judgment of the inspector.

Standard lengths, widths, and thicknesses of softwoods differ somewhat in the various rules and also in different classes of material and grades in the same rules. In some sets of rules standard sizes are not listed completely.

The various lumber products to which grades are given by the different lumber associations generally include finish, flooring, siding, ceiling, boards, timbers, fencing, etc. The methods of describing the grades of various associations differ widely. In some rules the letters A, B, C, and D are used to designate grades of material for finish, ceiling, flooring, etc., and the numbers 1, 2, 3, and 4 usually with the term "Common" are used for grades of common lumber, boards, dimension, etc. Other rules designate

their highest grades of finish as 1, 2, and 3 Clear, either with or without lower grades of finish material designated A, B, C, and D.

DESCRIPTION OF TYPICAL RULES.

Following is a description of the grading rules of a few of the most important species.

SOUTHERN YELLOW PINE.

Southern yellow pine includes longleaf, shortleaf, loblolly, and associated species of minor importance, such as slash and pond pine. The grading rules in common use are as follows:

(1) Georgia-Florida Sawmill Association Rules, consisting of the "Interstate Rules of 1916" and "Grading and Dressing Rules for Planing Mill Products," used principally in the southeastern United States and in Atlantic coast markets.

(2) Southern Pine Association Rules, used largely by Gulf State manufacturers for inland trade. The Southern Pine Association has also adopted "The Gulf Coast Classification of Pitch Pine" for export trade.

(3) North Carolina Pine Association Rules used on the Atlantic coast.

The Interstate Rules of 1916, which are used by the Georgia-Florida Sawmill Association and by lumber trade associations of the Atlantic coast for dimension and timbers, are characterized principally by their simplicity. They are divided into three parts—general rules, classification, and inspection. Seven classes of lumber are given—flooring, boards, plank, scantling, dimension, stepping, and rough edge or flitch. The sizes are given for each class. Under inspection three grades are given—standard, merchantable, and prime. Prime is the highest grade. These grades are based on number and position of defects and amount of heart. The 1916 rules differ from the old 1905 rules in that they contain a density requirement.

"The Grading and Dressing Rules for Planing Mill Products," also used by the Georgia-Florida Sawmill Association, apply to ordinary lumber products, such as dressed finishing, panel shop, flooring, ceiling, siding, etc. The grades A, B, and C are used for the higher-class products, while the grades for other products, such as common boards, fencing, etc., are designated as Nos. 1, 2, and 3, Common. The defects recognized include knots, splits, wane, red heart, rotten streaks, torn grain, sap stains, and crooks.

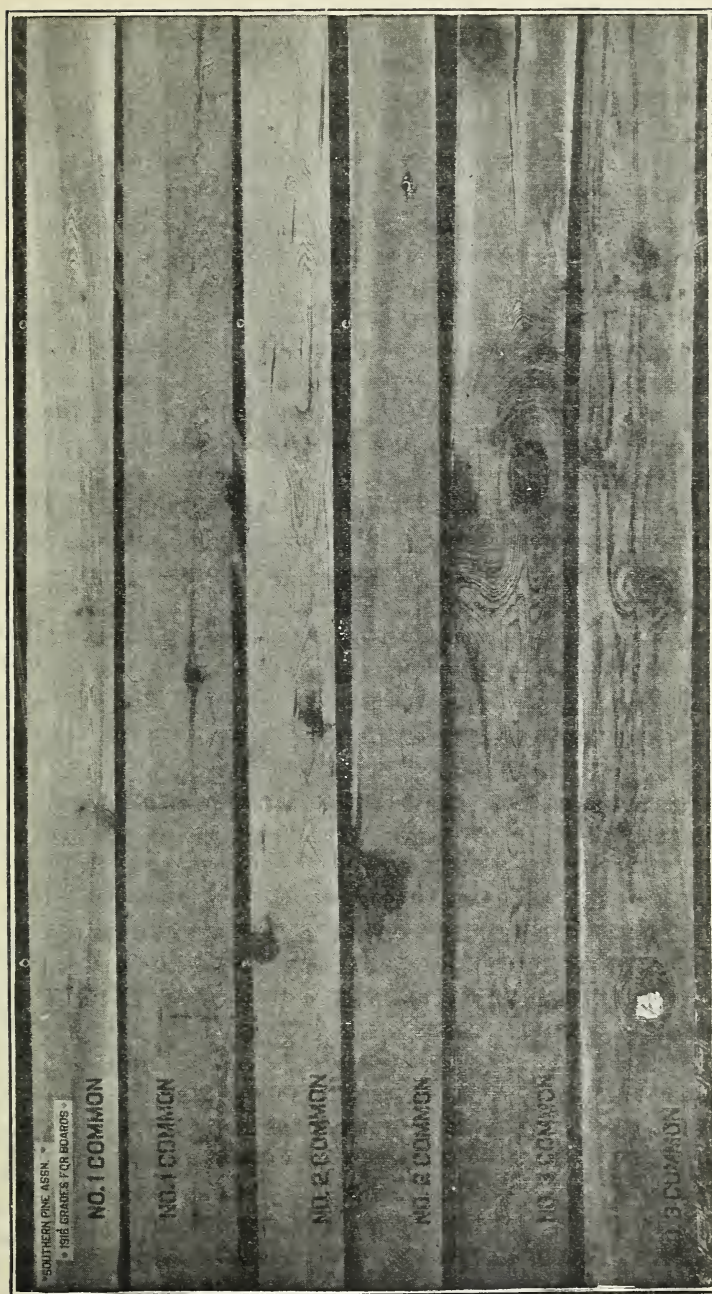


FIG. 4.—Southern yellow pine boards graded by Southern Pine Association rules. Two samples of each of the grades Nos. 1, 2, and 3 Common.

SOUTHERN PINE ASSOCIATION RULES.

Separate rules are issued for (1) lumber, (2) timbers, (3) car material, and (4) bridge and trestle timbers. The Gulf Coast Classification of Pitch Pine is also used, and is issued in revised form by the Southern Pine Association.

The Southern Pine Association Rules for grades of yellow-pine lumber are a revision of the old Yellow Pine Manufacturers' Association Rules. They give a large number of different products, such as finishing, flooring, ceiling, common boards, dimension, etc. The grades are defined under each of these classes. The letters A, B, and C are used to designate the higher grades for finish and planing-mill products, and the numbers 1, 2, and 3 with the term "Common" are used for lower grades of planing-mill products, common boards, and dimension. The defects allowed in each grade are not the same in the different classes of products; they vary with the sizes and requirements of each class. In general, the material is graded from the face or best side.

Grade A is practically free from defects on one side, except in the greater widths. B allows a few minor defects, as splits, small knots, and pitch pockets.

The Common grades allow larger defects and a greater number of defects than A, B, and C. Figure 4 shows two examples of each of the grades Nos. 1, 2, and 3 Common for boards. No. 1 Common in general allows sound knots not over a certain diameter, or smaller defects which do not impair its use for certain purposes; No. 2 Common allows knots not necessarily sound and not more than a certain specified diameter, and other defects if not too large; No. 3 Common allows coarse knots, knot holes, and other defects if not too injurious for its use; while No. 4 Common is "defective lumber."

The Southern Pine Association Rules for timbers include the "density" rule prepared by the Forest Service to secure high-grade structural material. This rule requires a proportion of one-third summerwood (the hard, dark-colored part of the annual ring) in the cross section and at least six annual rings per inch,¹ and disregards botanical distinctions in the southern pines. The Southern Pine Association grades for timbers are No. 1 Common, Square Edge and Sound, Merchantable, and Select Structural, which is the highest grade. The first three of these grades may or may not require material to be graded under the density rule, depending upon whether "dense" or "sound" is specified, the term "dense" being used to specify material conforming to the density rule and "sound" to include material without the density-rule requirement. No. 1 Com-

¹ In material with less than six rings per inch 50 per cent summerwood in the cross section is required.

mon Timbers are not required to conform to the General Timber Specifications, which exclude injurious shakes and unsound knots; there are restrictions, however, on the amount of wane and size of knots for different sizes of material. Square Edge and Sound Timbers must be free from wane. Merchantable Timber must have approximately two-thirds heart on the wide faces. The "Select Structural" grade conforms to the density rule and also has restrictions as to knots, shakes, checks, and cross grain recommended by the Forest Service. Wane is not permitted in this grade. There must be at least 85 per cent heart, measured around the girth anywhere in the length.

Figures 5 to 8 are from photographs of cross sections of southern yellow pine illustrating the application of the density rule in selecting structural timbers. The material in figure 5 is of very high quality, exceeding by a considerable margin the requirements of the density rule for one-third summerwood in the cross sections. In figure 6 material with a lower percentage of summerwood is shown, although of sufficient density to qualify in the Select Structural grade. Figure 7 shows timber that fails to meet the requirements of the density rule by a small margin, and figure 8 shows southern yellow pine of low quality from a structural standpoint which fails by a considerable margin to meet the requirements of the density rule.

The Southern Pine Association specifications for southern yellow pine car material are those adopted by the Master Car Builders' Association and the American Railway Master Mechanics' Association. The following products and grades are provided:

Siding-----	B and Better, Select, and No. 1 Common.
Lining-----	B and Better, Select, and No. 1 Common.
Roofing-----	B and Better, Select, and No. 1 Common.
Decking or flooring----	All Heart, Heart Face, and No. 1 Common.

The Southern Pine Association "Bridge and Trestle Timbers" rules follow the specifications of the American Railway Engineering Association except that the density rule takes the place of botanical distinctions between different species of the southern pines. The rules include such bridge parts as stringers, caps, sills, posts, struts, etc. Three grades are provided: (a) Standard Heart Grade, Dense Pine; (b) Standard Grade, Dense Pine; and (c) Standard Grade, Sound Pine. In the heart grade from 75 to 85 per cent of heart is required. In stringers heart is measured around the girth. In caps and sills each of the four sides must show 85 per cent heart, measured anywhere in the length. Other bridge parts have the heart requirements measured in various ways.

The Gulf Coast Classification of Pitch Pine Resawed Lumber and Sawed Timber was first issued by the old Gulf Coast Lumber Exporters' Association and adopted in 1915 by the Southern Pine Asso-



FIG. 5.—Cross sections of southern yellow pine of high quality. Such material exceeds the requirements of the density rule by a wide margin.

	Species.	Per cent summerwood.	Rings per inch.
Sample <i>a</i>	Long leaf pine.....	52	21
Sample <i>b</i>	do.....	47	16
Sample <i>c</i>	do.....	52	7

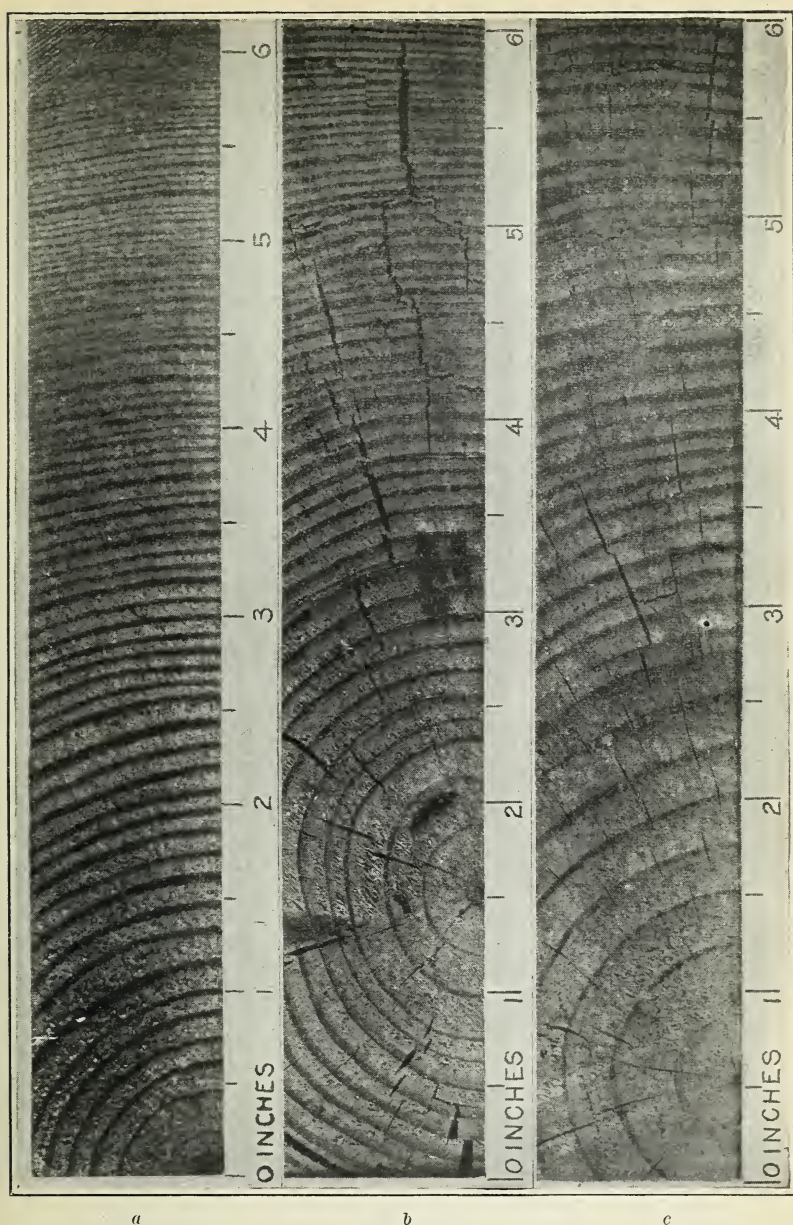


FIG. 6.—Cross sections of southern yellow pine of good quality. Such material exceeds the requirements of the density rule by a small margin.

	Species.	Per cent summerwood.	Rings per inch.
Sample <i>a</i>	Longleaf pine	35	13
Sample <i>b</i>	Shortleaf pine	40	18
Sample <i>c</i>	Loblolly pine	37	8

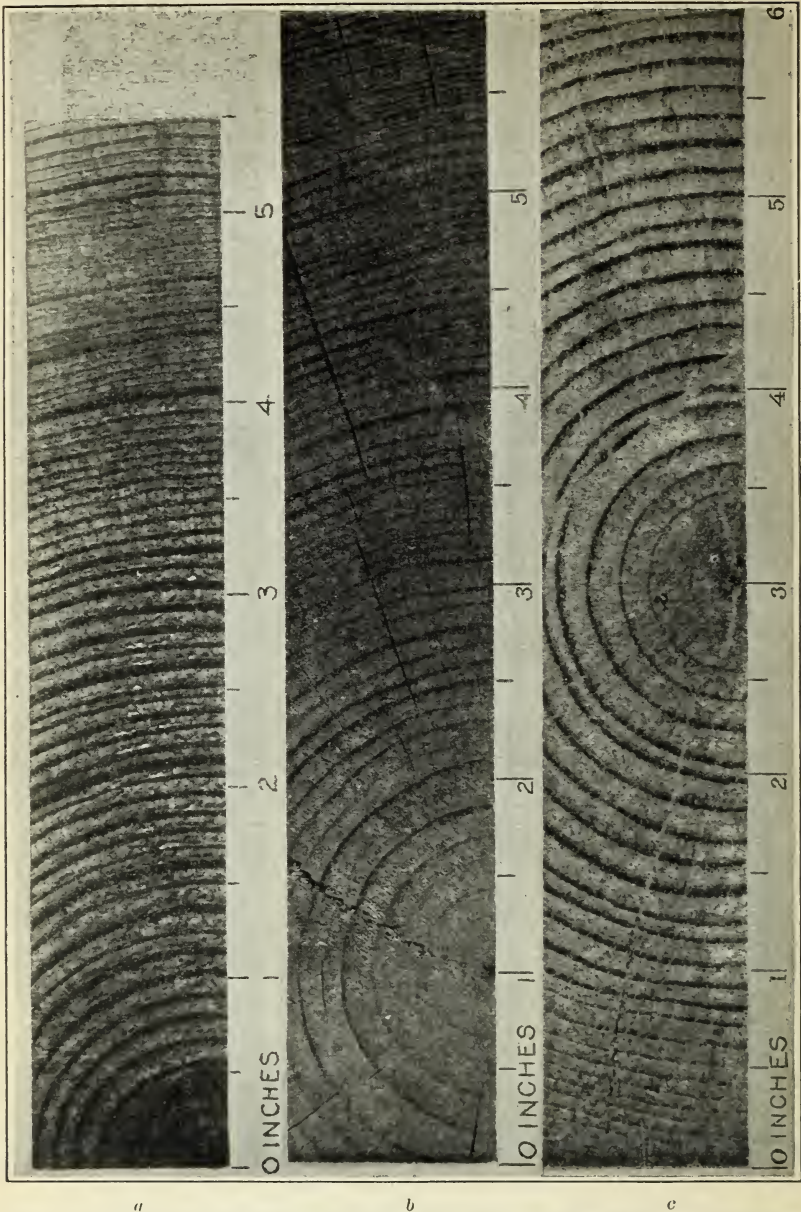


FIG. 7.—Cross sections of southern yellow pine of medium quality. Such material fails to meet the requirements of the density rule by a small margin.

	Species.	Per cent summerwood.	Rings per inch.
Sample <i>a</i>	Longleaf pine.....	31	14
Sample <i>b</i>	Shortleaf pine.....	25	12
Sample <i>c</i>	Longleaf pine.....	25	10

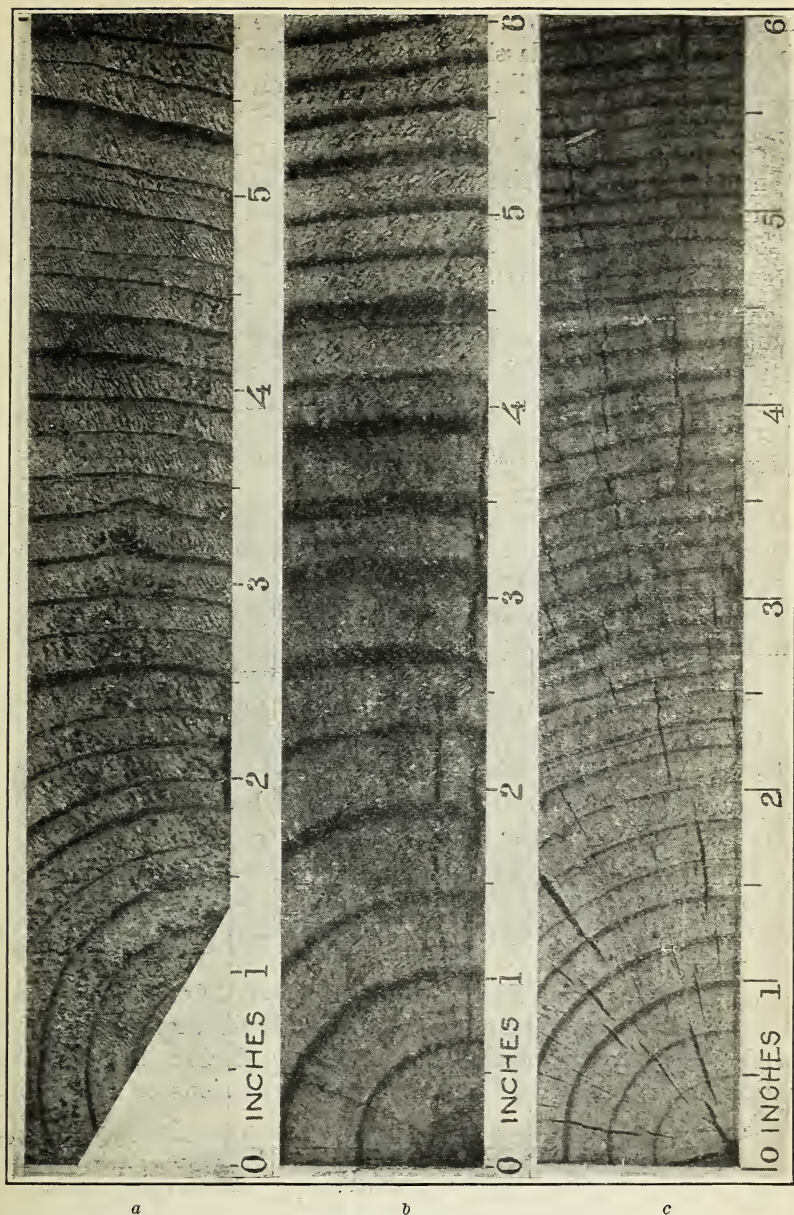


FIG. 8.—Cross sections of southern yellow pine of poor quality. Such material fails to meet the requirements of the density rule by a considerable margin.

	Species.	Per cent summer-wood.	Rings per inch.
Sample <i>a</i>	Shortleaf pine.....	14	5
Sample <i>b</i>	Loblolly pine.....	25	3
Sample <i>c</i>	Shortleaf pine.....	23	7

ciation for export trade. Under "Resawed lumber" the different kinds of lumber are classified as flooring, boards and planks, deals, scantling, dimension, kiln-dried saps, and air-dried saps. The sizes are given under each class and also the grades, which are for the most part as follows: Special or Crown, Extra or French Prime, Prime, Standard or Genoa Prime, Merchantable, and Square Edge. The grades differ as to amount of heart and defects specified and the same grade differs to a greater or less degree in its requirements in the different classes of material. Two other brief sets of rules are given, "Usual South American or Standard River Plate" and "West Indian." Under "Sawed timber" are brief rules adapted for use with this class of material. All these rules have high heart specifications in comparison to rules used in domestic trade.

NORTH CAROLINA PINE ASSOCIATION RULES.

The grading rules for kiln-dried North Carolina pine adopted by the North Carolina Pine Association apply to lumber 1 to 2 inches in thickness. The principal grades are No. 1, 2, 3, and 4, or Box. Examples of these grades are shown in figure 1. No. 1 must be practically clear of defects up to 8 inches in width, except a limited amount of pitch streak. No. 2 grade allows a limited number of small sound knots and other small defects; No. 3 allows larger tight knots; and No. 4, or Box, contains large reasonably sound knots and other smaller defects. There are also several minor grades which are largely cull and from which merchantable lumber can be cut with a specified maximum per cent of waste.

The grading rules for air-dried North Carolina pine are the same as for kiln-dried except that 25 per cent sap stain is allowed for No. 2, 50 per cent for No. 3, 75 per cent for No. 4, or Box, and 100 per cent for Culls.

The Shortleaf Pine Plank and Dimension Rules consist of a set of brief general rules defining a single grade for these classes of material. They are the official rules of the North Carolina Pine Association and a number of lumber trade associations on the Atlantic coast.

WHITE PINE—EASTERN OR NORTHERN.

Eastern or northern white pine (*Pinus strobus*) is graded by two sets of rules, those of the Northern Pine Manufacturers' Association and those of the White Pine Association of the Tonawandas.¹

¹ The White Pine Bureau of St. Paul, Minn., composed of manufacturers of northern and Lake States white pine, issued in 1917 a book containing the rules of the Northern Pine Manufacturers' Association, the Western Pine Manufacturers' Association (see western yellow pine), and the White Pine Association of the Tonawandas, with several photographs of each grade and recommendations as to the use of each grade in house construction.

NORTHERN PINE MANUFACTURERS' ASSOCIATION RULES.

The Northern Pine Manufacturers' Association Rules are used by manufacturers throughout the Lake States. Under these rules several different classes of lumber are given, as finishing, siding, flooring, common lumber, etc., and each class has a number of grades. The better grades suitable for finish are designated as 1, 2, 3 Clear and A, B, C Select, etc.; while the grades more suitable for other purposes are indicated as Nos. 1, 2, 3 Common, etc. The grades 1, 2 and 3 Clear and A and B Select are frequently not sorted but simply sold together as B Select and Better. These rules differ considerably from the Tonawanda Rules, so that a detailed comparison is difficult. Examples are given in the rules under each grade to illustrate different combinations of defects admissible. These rules apply also to Norway pine, spruce, and tamarack cut in the Lake States.

TONAWANDA RULES.

The Tonawanda Rules were drawn up by the White Pine Association of the Tonawandas and are used in the Tonawanda wholesale district (Buffalo, Tonawanda, and North Tonawanda, N. Y.) and other eastern markets, principally on material brought by boat from the Georgian Bay district and northern Minnesota. The rules contain grades as follows: Uppers, Selects, Fine Common, Nos. 1, 2, and 3 Cuts, Nos. 1 and 2 Moulding, Stained Saps, Star or Shaky Clear, No. 1 Shelving and Dressing, No. 2 Dressing, Nos. 1 and 2 Shelving, Nos. 1, 2, and 3 Barn, and No. 1 Box. The large number of grades allows considerable refinement in grading and provides grades especially suited for certain purposes. Common defects specified are knots, sap, sap stain, and shake. Particular uses for which each grade is suitable are given under each grade.

DOUGLAS FIR.

Douglas fir is commonly graded under three sets of rules, one for rail shipments, one for domestic-cargo shipments, and one for export. The rules are issued by the West Coast Lumbermen's Association and the Pacific Lumber Inspection Bureau.¹

These are separate organizations which cooperate closely. The Pacific Lumber Inspection Bureau is in effect the inspection department of the West Coast Lumbermen's Association.

WEST COAST LUMBERMEN'S ASSOCIATION RULES ("RAIL A").

The "Rail A" rules cover Douglas fir and western hemlock, which are graded together, and also Sitka spruce and western red cedar,

¹A small amount of Douglas fir is also graded by the rules of the Western Pine Manufacturers' Association (see western yellow pine).

both of which are graded separately. In the "Rail A" rules for Douglas fir and western hemlock there is first a division made into a large number of classes of lumber, as flooring, ceiling, finish, common, dimension, timbers, etc., and a number of grades are given under each class. The principal grades are Nos. 1, 2, 3, and 4 Clear Selected Common, and Nos. 1, 2, and 3 Common. The grade No. 1 Clear, however, is given only in vertical grain flooring and is practically free from all defects. No. 2 Clear admits a few small defects, varying with the class of material. The "Clear" grades are finish material, while the "Common" grades are intended for other purposes, such as common boards and timbers. Defects allowable in "Common" grades are naturally more serious than those in the "Clear" grades. Grades of the same name under different classes of material are somewhat similar as to defects allowed; there are sometimes wide differences, however, both as to sizes and kinds of defects allowed, due to the requirements of a particular class of material.

Douglas fir timber varies widely in the quality of the wood itself, aside from defects. Figure 9 shows cross sections of Douglas fir. The two upper sections represent dense, high-grade material suitable for uses in which strength is necessary. The two lower sections represent material of low grade for structural purposes. The wide difference in the quality of the upper two and lower two sections indicates the need of a grading rule that will differentiate between them. The West Coast Lumbermen's Association has very recently adopted the Forest Service density rule for securing high-grade structural material.¹

The West Coast Lumbermen's Association also insures separate standard specifications for Douglas fir car material. The products and grades listed in these rules are as follows:

Siding, lining, roofing.....	No. 2 Clear and Better, Edge Grained.
Siding, lining, roofing.....	No. 2 Clear and Better, Flat Grained.
Decking, sills, framing.....	Select Common.
Decking, sills, framing.....	No. 1 Common.

PACIFIC LUMBER INSPECTION BUREAU RULES.

Two sets of rules, Export and Domestic, are issued by the Pacific Lumber Inspection Bureau for the use of cargo shippers.

Export Rules.—Several classes of lumber are given, as Clears, Ship Plank, Deck Plank, Flooring, Ceiling, Siding, etc. Some of these classes have several grades and some but one. Boards are graded as No. 2 Clear and Better (Edge and Flat Grain), Merchant-

¹ The density rule adopted by the association provides that material shall show on one end at least six annual rings to the inch and at least one-third summerwood measured over a prescribed distance of 3 inches. Material with less than six rings to the inch shall show one-half summerwood.

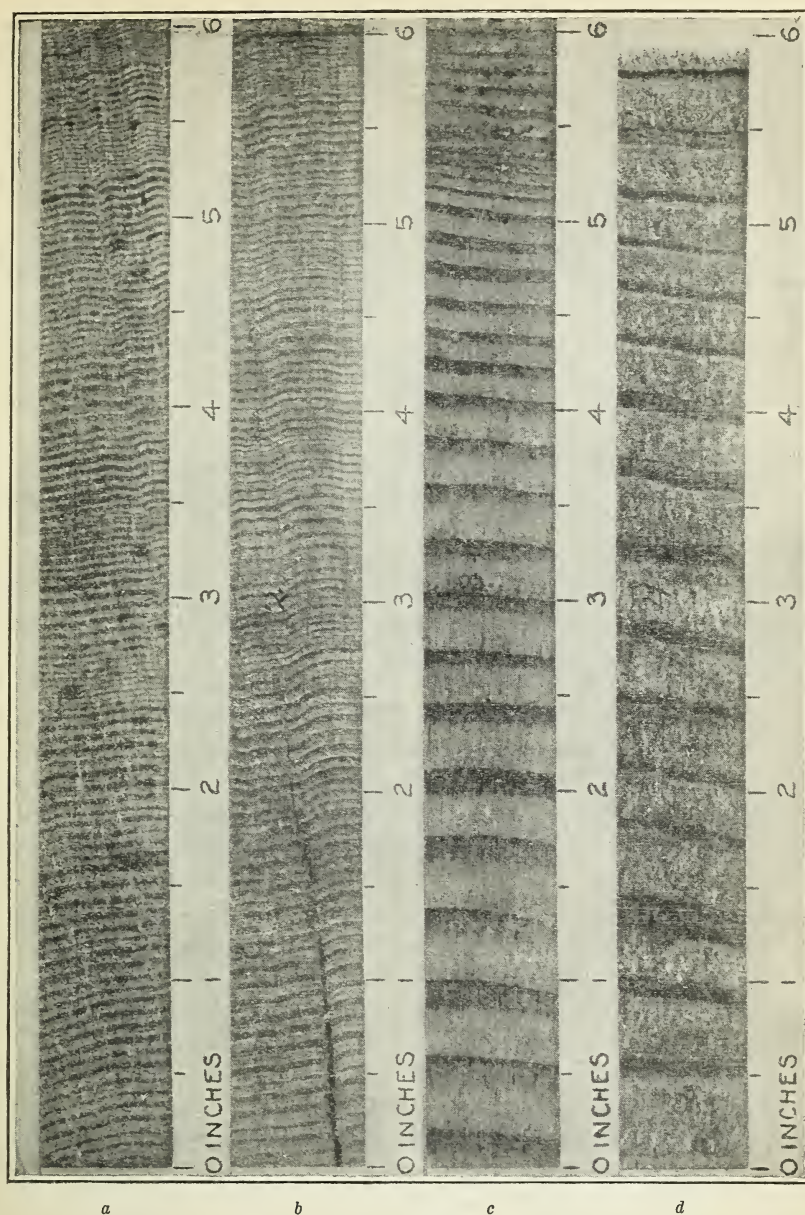


FIG. 9.—Cross sections of Douglas fir for structural purposes. Sections *a* and *b* represent dense, high-grade material, and sections *c* and *d* represent material of low grade.

	Per cent summerwood.	Rings per inch.
Specimen <i>a</i>	45	20
Specimen <i>b</i>	37	19
Specimen <i>c</i>	27	4
Specimen <i>d</i>	23	3

able, and Common. Flooring grades are Nos. 1, 2, and 3 Clear Edge Grain and No. 2 Clear and Better and No. 3 Clear Flat Grain. Stave grades are No. 1 and No. 2. Other products are manufactured in one grade only.

Domestic Rules.—A classification is made into rough clears, common, factory lumber, flooring, ceiling, siding etc., and under each class several grades are given, as Nos. 1, 2, 3, and 4 Clear, No. 2 Clear and Better, Selected Common and Nos. 1, 2, and 3 Common. These grades usually differ considerably under each of the different classes. No. 2 Clear and Better in general allows a small number of small tight knots and pitch pockets; No. 3 Clear allows a large number of larger knots and pitch pockets. In the "Common" grades larger knots, pitch pockets, colored sap, and other defects allowable in construction material are admitted. Specifications are given for quite a number of products, such as tanks, cross arms, silo and pipe stock, ship planks and decking, mining timber, and railroad ties.

The two sets of rules of the Pacific Lumber Inspection Bureau differ both as to classes of material and grades. There are a few grades, however, such as ship plank and flooring, which are practically the same in both sets of rules.

IDAHO WHITE PINE AND WESTERN YELLOW PINE.

(*Pinus monticola* and *Pinus ponderosa*.)

Idaho white pine and western yellow pine (called western white pine in the manufacturers' rules), spruce, white fir, cedar, larch, and Douglas fir cut in the Inland Empire (western Montana, Idaho, and eastern Washington and Oregon) are graded under the rules of the Western Pine Manufacturers' Association. They are nearly the same as the Northern Pine Manufacturers' Association Rules for northern white pine. The higher grades of the Northern Pine Manufacturers' Rules are omitted, however, and slight changes have been made in specifying defects to adapt the rules to the western species.

The grades designated as "Clear" and also "A Select," in the Northern Pine Rules, are omitted in these rules. "B Select and Better" is therefore the highest grade of material, and admits small sound knots, slight stain, and slight traces of pitch or small season checks. Several examples are given in the rules under each grade for illustration.

Western yellow pine throughout the southern Rockies, the middle Rockies, and the Black Hills is graded under the rules of the Western Pine Manufacturers' Association. Western yellow pine cut in California and sold as California white pine is graded under the rules of the California White and Sugar Pine Association.¹

¹ See sugar pine.

SUGAR PINE.

Sugar pine in California is graded under the rules of the California White and Sugar Pine Association. The rules are patterned after those of the Northern Pine Manufacturers' Association. The highest grade No. 1 and 2 Clear is as nearly equivalent to the northern white pine B Select and Better as the timber characteristics of the two regions permit. No. 3 Clear is a cutting grade. Other grades are similar to the northern pine grades. California white pine (western yellow, *Pinus ponderosa*) is also graded under the California rules.

HEMLOCK.

WESTERN HEMLOCK.

In the Pacific Northwest western hemlock is graded under the Rail A rules of the West Coast Lumbermen's Association and the Domestic and Export rules of the Pacific Lumber Inspection Bureau. In each rule the grades are practically the same as the Douglas fir grades, although hemlock products are limited to flooring, ceiling, partition, different kinds of siding, finish, boards, shiplap, and dimension. In a number of the lower grades a certain percentage of hemlock is allowed mixed with an order for Douglas fir. In fact, in the grade of No. 3 Common¹ for Douglas fir boards, dimension, plank, and small timbers any proportion or all hemlock is allowed. Douglas fir mining timber may be 15 per cent hemlock. In No. 3 Clear flat flooring and in No. 3 and 4 Clear ceiling, partition, and siding hemlock in any quantity is permitted.

EASTERN HEMLOCK.

In the Lake States eastern hemlock is graded under the Northern Hemlock and Hardwood Manufacturers' Association Rules and the Michigan Hardwood Manufacturers' Association Rules. Both sets of rules include the products "Boards and Strips" and "Piece Stuff and Dimension." Boards and Strips have 10 grades under the Northern rules and 6 grades under the Michigan rules. The highest grade of hemlock under the Northern rules is Thick D and Better, and under the Michigan rules C and Better. Both include the grades Nos. 1, 2, 3, and 4 Common for Boards and Strips. Other products made in the Northern rules are flooring, ceiling, shiplap, and drop siding, but no grades are listed.

Hemlock in New England, New York, and Pennsylvania is graded largely by local rules, although Lake States grades are sometimes used in New York.

¹ In this grade Douglas fir, hemlock, larch, spruce, or cedar may be included when Douglas fir is ordered.

In the local rules the grade "Merchantable" is frequently used and sometimes the grade "Mill Run Mill Culls Out." In West Virginia and North Carolina the Spruce Manufacturers' Association Rules¹ are followed to some extent.

CYPRESS.

Grading rules for cypress are issued by the Southern Cypress Manufacturers' Association and the National Hardwood Lumber Association.

The rules of the Southern Cypress Manufacturers' Association were designed especially for selling to retailers. The high grades for lumber are A, B, and C, A having a perfect heart face in widths below 6 inches. The Common grades for lumber are Select Common, Heart Select Common, No. 1 and No. 2 Common. Box and Peck is the lowest grade. Flooring, siding, partition, and ceiling grades are A, B, C, and D. One grade each is provided for tank stock, switch ties, crossties, panel stock, shorts, battens, squares, car roofing, car siding, and car lining. The factory grades for lumber are Factory Selects and Shop.

The National Hardwood Lumber Association Rules for cypress are intended to serve both the retail and factory trade. The grades partake of the nature of both hardwood and softwood rules. The grades for lumber are Firsts and Seconds, Selects, Nos. 1 and 2 Shop, Nos. 1 and 2 Common, Nos. 1 and 2 Boxing and Peck. Dressed finish is graded A, B, C, and D Finish. Siding, flooring, and ceiling grades are A, B, C, and D. In addition, there is one grade each for tank stock, partition, car roofing, car siding, car lining, battens, and turning squares.

REDWOOD.

Redwood is graded by the rules of the California Redwood Association. The grades are divided into two classifications—Uppers and Sundry Commons. Uppers are the finishing grades, and include Clear, Sap Clear, Select, and Standard. The Sundry Common grades are Extra Merchantable, Construction, Merchantable, and Shop. Merchantable is not a distinct grade. It is made up of 60 per cent "Extra Merchantable" and the balance "Construction." The Shop Common grades are for factory use. These rules are used mostly for western trade, and a somewhat different set of rules is used for Eastern trade. However, the eastern rules are not published by the association, but can be found only in price lists, and are, therefore, difficult to refer to. Among the products and grades used for the eastern trade are the following:

¹ See eastern spruce.

Product.

Grades.

Finish	Clear, A and B.
Ceiling	Clear, A and B.
Drop siding	Clear, A and B.
Rustic	Clear, A and B.
Porch flooring	Clear, A and B.
Car siding	Clear, A and B.
Car roofing	Clear, A and B.
Siding (bevel, colonial, bungalow)	Clear, A and B.
Clapboards	Clear and Clear Sap.
Pattern stock	Vertical Grain, Clear, and B.
Factory lumber	Shop.
Squares	Clear and A.
Tank stock	Clear and Select.
Silo stock	Clear and Select.
Pipe staves	Clear and Select.
Boards and dimension	Merchantable and Extra Merchantable.

The bigtree or sequoia, of the same family as redwood, is sometimes cut for lumber, which is often graded by the Redwood rules.

EASTERN SPRUCE.

Eastern spruce is graded in the Lake States under the rules of the Northern Pine Manufacturers' Association.

In the New England States there is no published set of rules in use, but custom has brought about a general understanding of what is "Merchantable" and "Box." Sometimes spruce box lumber in New England is sold round edge mixed with round-edge white pine.

In the Adirondacks no published rules are available, but here again custom has made the following grades, which are currently quoted in New York City: No. 1 and Clear, No. 2, No. 2 Mill Run—Mill Culls Out, and Mill Culls.

In West Virginia and North Carolina the rules largely used are those of the Spruce Manufacturers' Association, which provide for the following grades of lumber: Firsts and Seconds, Selects, Dressing, Merchantable, Box, and Mill Culls. Firsts and Seconds must be practically clear on one face and both edges. Bright sap is not considered a defect.

SITKA SPRUCE.

Sitka spruce is graded under the Rail A rules of the West Coast Lumber Manufacturers' Association and both the Domestic and the Export rules of the Pacific Lumber Inspection Bureau. The Rail A and Domestic rules have identical grades for spruce—finish, factory lumber, and box lumber. The Rail A rules give some 22 products in all, with one to four grades for each. The Domestic rules contain only the products previously mentioned. The Export rules of the Inspection Bureau have four products: Rough clear, rough shelving, round merchantable, and merchantable box, with one or two grades each.

ENGELMANN SPRUCE.

Engelmann spruce is graded under the rules of the Western Pine Manufacturers' Association.

TAMARACK AND LARCH.

Throughout the Lake States tamarack is graded under the rules of the Northern Pine Manufacturers' Association.

In the Inland Empire (Idaho, western Montana, and eastern Washington and Oregon) the rules of the Western Pine Manufacturers' Association are used for larch.

SOUTHERN RED CEDAR (*Juniperus virginiana*).

Red cedar lumber is usually sold log run, as no definite rules are established.

WESTERN RED CEDAR.

Western red cedar is graded under the rules of the West Coast Lumber Manufacturers' Association and the Pacific Lumber Inspection Bureau Domestic Rules. The rules covering Western red cedar in these two sets of rules are nearly the same. The Bevel Siding grades in both rules are Clear, A, and B, while finish and boards are graded as No. 2 Clear and Better, and Nos. 1 and 2 Common, respectively. Bungalow or colonial siding and porch decking have but one grade in both rules. In the Inland Empire a few grades of the Western Pine Manufacturers' Association are used for western red cedar to a very small extent.

SOUTHERN WHITE CEDAR.

No standard rule is in general use. Planking for boats is usually bought under the term "Boat Boards." This is sound lumber in which knots are allowed, providing they are tight. The Navy Department has prepared satisfactory specifications for southern white cedar boat boards.

PORT ORFORD CEDAR.

The Domestic rules of the Pacific Lumber Inspection Bureau provide the following products for Port Orford cedar grades:

Product.	Grade.
Boat Boards.....	One grade.
Lumber.....	No. 1 and No. 2 Clear or B and Better. No. 3 Clear or Factory C. No. 1 Shop Common. No. 2 Shop Common. Common Boards and Dimension. No. 3 Boards and Dimension.
Bevel siding.....	Clear, A, B.
Sap clear strips.....	Select or C.

Boat boards are furnished in 22 to 32 foot lengths. Oil streaks to which the wood is subject are not considered defects in any grade.

The product designated as sap clear strips is intended as material for siding, flooring, ceiling, and finish.

LOGEPOLE PINE.

In the Inland Empire the rules of the Western Pine Manufacturers' Association are used. Very little of this species is graded, however, the great bulk of it being used for mine timbers and local consumption, for which there are no grading rules in general use. In the Rocky Mountain regions it is cut almost entirely by small mills and no association rules are in general use for such material.

WHITE FIR.

White fir, including several firs of minor importance, is sold in the Inland Empire under the rules of the Western Pine Manufacturers' Association. In Washington and Oregon it is admitted in the grade of No. 3 Common boards under the "Domestic" rules of the Pacific Lumber Inspection Bureau and the "Rail A" rules of the West Coast Lumbermen's Association.

In California white fir is reported as sold under the rules of the California White and Sugar Pine Association in the common grades.

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